

# International Sustainability

## IEA Bioenergy Task 38

WBS: 4.2.1.31 and 6.4.0.6



**Helena L. Chum** National Renewable Energy Laboratory

## Analysis and Sustainability

U.S. Department of Energy's Bioenergy Technologies Office

2017 Project Peer Review

Sheraton Denver Downtown, Denver, CO

March 8, 2017

# Goal Statements

1. Analyze and synthesize key global bioenergy/bioeconomy activities to identify opportunities and challenges for the expansion of the U.S. bioeconomy and sustainability together.
2. Improve sustainability assessments (environmental, social, economic) of integrated systems by providing technical and analytical expertise.

## Outcomes

### Contribute to bioenergy/bioeconomy areas

- Overall benefits and impacts
- Climate, environment, social and economic methodologies and best practices
- Benefits verification
- The contexts for expansion of bioenergy and sustainability together

## Relevance

### Engage international partners on critical areas for the success of an advanced bioenergy/bioeconomy (BB) industry

- improving sustainability models and metrics
- expanding the knowledge base for sustainability analysis
- Increase understanding of sustainability implications of increased BB production
- SCOPE #72 “comprehensive and inter-disciplinary expert work, extensively reviewed, addressing basically all aspects of sustainability” Sustainability Manager, Novozymes

# Quad Chart Overview

## Project Timeline

Start Date	FY17
End Date	FY19
% Complete	NREL: 20%

## Budget

**WBS 4.2.1.31: International Sustainability**

**WBS 6.4.0.6: IEA Bioenergy T38 - travel**

Funding Source	FY2016 Costs <sup>1</sup>	FY2017 Cost (1/17) <sub>2</sub> / remaining <sub>2</sub>	FY2018 request	FY2019 request
4.2.1.31	\$185K	\$89K/\$246K	\$300K	300K
6.4.0.6	\$27.6K	\$13.4K/\$30K	\$30K	\$30K
Cost Share Partners		Est. \$250K c, d, b, a		

1. Related RSB cost-shared subcontracted work started in FY2016

2. Work with ERG to start in FY2017

**Barriers Addressed: evaluate/disseminate practical tools that enhance sustainable bioenergy outcomes and best practices**

- St-A: Scientific Consensus
- St-B: Consistent, Evidence-Based Message
- St-E: Best Practices
- Mm-A: Lack of Understanding Environmental/Energy Tradeoffs
- Mm-B: Inconsistent or Competing Policies and Drivers to Facilitate Multi-Sector Shift

## NREL and Partners

- a. Roundtable on Sustainable Biomaterials (RSB) Standards Director, Elena Schmitt
- b. IEA Bioenergy Task 38 members
- c. IEA Bioenergy Task 39 members working jointly with Task 38, CTBE, Campinas, Brazil
- d. SCOPE Bioenergy and Sustainability: update, FAPESP, Glaucia de Souza
- e. Sustainability Lab partners ORNL, ANL, INL
- f. ERG/Franklin Associates

# Key Objectives

**1.1 Reduce** barriers for the U.S. industry in stimulating a domestic bioeconomy with valuable exports by facilitating the regionalization of a leading global voluntary sustainability system (VSS) for North America.

**1.2 Harmonize** and improve LCA methodologies and frameworks on three pillars (economic, environmental, and social) by working with IEA Bioenergy Task 38, other Tasks, and Intertask collaborators, and involving global assessments partners.

**2.1 Assess** how integrated assessment models incorporate new science-based evidence and their uncertainties

- Bioenergy potential, principally large scale.
- Role of bioenergy coupled with carbon capture and storage.

**2.2 Participate** in global high-level integrated multilateral assessments that develop high-impact publications on the future potential of the bioeconomy and disseminate findings.

# Global Context Related to the Bioeconomy




Framework Convention on Climate Change

 The United Nations System

- Specialized Agencies<sup>1,5</sup>**
- FAO Food and Agriculture Organization of the United Nations
  - ICAO International Civil Aviation Organization



5<sup>th</sup> Global Environmental Outlook

 **UNEP** United Nations Environment Programme

- UNESCO United Nations Educational, Scientific and Cultural Organization
- UNIDO United Nations Industrial Development Organization

5<sup>th</sup> IPCC Assessment Report



The Paris Agreement  
COP 21  
2015

Intended Nationally Determined Contributions

A Unique Partnership:  
 United Nations  THE WORLD BANK

 **IRENA**  
International Renewable Energy Agency

 **GBEP**  
Global Bioenergy Partnership

 UNITED NATIONS DECADE OF SUSTAINABLE ENERGY FOR ALL 2014-2024  
**SE4ALL**

Sustainable Bioenergy High-Impact Opportunity

 **International Energy Agency**  
Working together to ensure reliable, affordable and clean energy  
**IEA Bioenergy**

 **OECD**  
BETTER POLICIES FOR BETTER LIVES

# Management Approach – Partnerships

- **Top Challenges**

- Communication among multiple countries with differing governance systems and among the many fields of science, engineering, social ecology, economics, and other social sciences lead to conflicting assessments and polarization
- A large array of international multilateral partnerships includes fast growing public-private efforts from research to deployment and innovation
- Project outcomes are dependent on multiple collaborators and frequently are consensus based.

- **Management**

- Prioritize and select activities in consultation with DOE/BETO and EERE International.
- Select activities that assess or develop science-based information on key economic, environmental, and social aspects and inform BETO/govt. partners on lacking data or not clearly understood data.
- Stakeholder engagement and building consensus.
- Articulating the differences and outcomes can decrease communication barriers.
  - Teleconferences, webinars, planned activity meetings, emails
  - Informs the program on where expanded rigorous independent studies can clarify viewpoints in upcoming high-level assessments, shared with international partners.

# Technical Approach

## Top Challenges

- Lack of sustainability data for multiple contexts, including agriculture (forestry) that include adaptation and mitigation for climate, environment, and social benefits
- Lack of data on multiple resource use efficiency for the bioeconomy pathways

## Critical success factors

- Increased market stability (e.g., regulatory certainty) to foster continued private investment
- Continued collection of sustainability data on established commercial projects (first-of-a-kind) and incorporate generic knowledge into decision-making to decrease investment risk

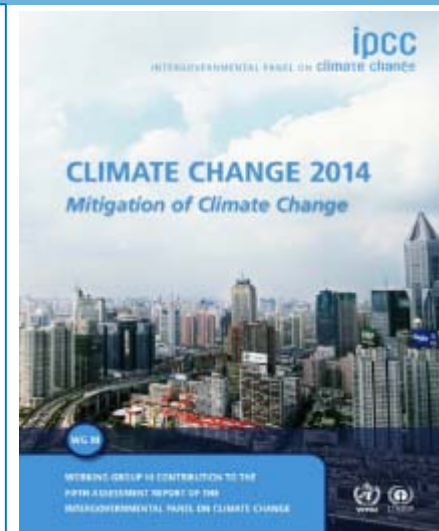
## Risks/mitigation of risks

- U.S. perspective may not be directly presented at key multilateral discussions
- ❖ Develop meta analysis in specific areas in the context of technology development and deployment and existing or developing sustainability assessment approaches
- ❖ Provide a systemic view including multiple feedstocks, supply chains, conversion pathways, product(s) and uses to identify gaps and their interactions

**With our contributions  
continue to increase**

**IPCC 5<sup>th</sup> Assessment Report  
Agriculture, Forestry, and  
Other Land Use Chapter,  
271 citations (from 2014)  
Energy Systems Chapter, 90**

**IPCC Special Report REN  
SRREN Bioenergy Chapter,  
315 citations (from 2011)**



**2016** Top 15 Most Downloaded Articles

**2015** #4 of Top 15 Most Downloaded Articles

**2014** Top 15 Most Downloaded Articles – 6 mo.



GCB Bioenergy (2014), doi: 10.1111/gcbb.12205

REVIEW

## Bioenergy and climate change mitigation: an assessment

FELIX CREUTZIG<sup>1</sup>, N. H. RAVINDRANATH<sup>2</sup>, GÖRAN BERNDES<sup>3</sup>, SIMON BOLWIG<sup>4</sup>, RYAN BRIGHT<sup>5</sup>, FRANCESCO CHERUBINI<sup>5</sup>, HELENA CHUM<sup>6</sup>, ESTEVE CORBERA<sup>7</sup>, MARK DELUCCHI<sup>8</sup>, ANDRE FAAIJ<sup>9</sup>, JOSEPH FARGIONE<sup>10</sup>, HELMUT HABERL<sup>11,12</sup>, GARVIN HEATH<sup>6</sup>, OSWALDO LUCON<sup>13</sup>, RICHARD PLEVIN<sup>14</sup>, ALEXANDER POPP<sup>15</sup>, CARMENZA ROBLEDÓ-ABAD<sup>16</sup>, STEVEN ROSE<sup>17</sup>, PETE SMITH<sup>18</sup>, ANDERS STROMMAN<sup>5</sup>, SANGWON SUH<sup>19</sup> and OMAR MASERA<sup>20</sup>

Most comprehensive and critical review  
so far of positive and negative aspects

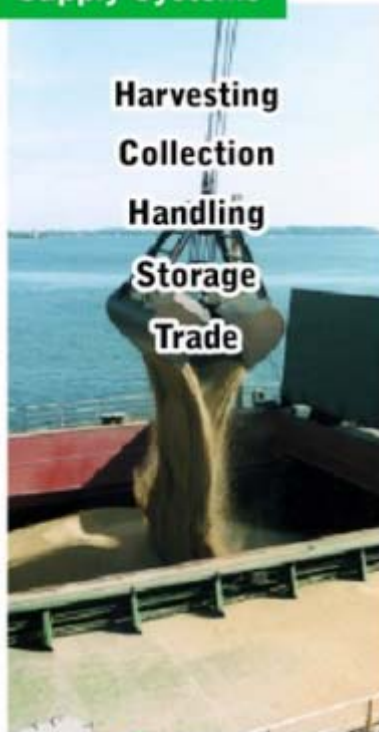


# IEA Bioenergy activities closely support BETO's, share R&D costs, multiply technical resources from R&D to deployment

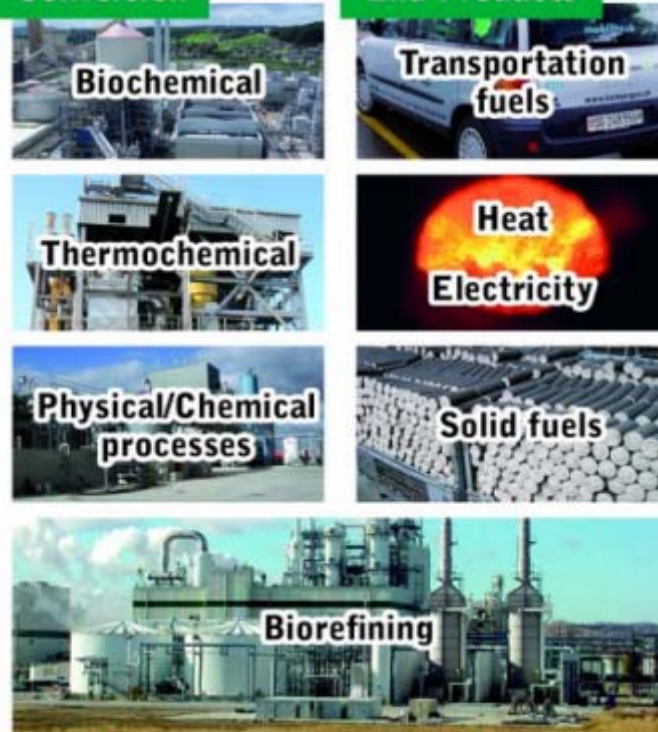
## Biomass Resources



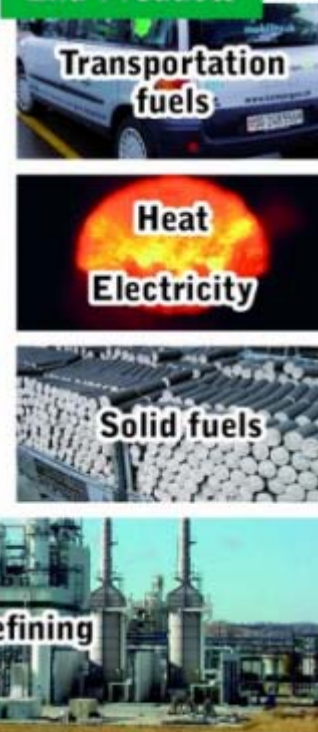
## Supply Systems



## Conversion



## End Products



Integrating research themes across the value chain: biorefineries, environmental and economic sustainability, system studies, fuel standards, greenhouse gas balances, life cycle analysis, barriers to deployment, management decision support systems, health and safety standards

## Crosscutting

Strengthen national R&D.  
Share research costs.  
Enhance the quality of R&D outputs

Investigate barriers to implementation.  
Standardize methodologies.  
Harmonize technical standards.

Accelerate deployment  
Contribute to energy policy development

# Harmonizing LCA methodologies used in regulations globally - Objectives

## IEA Bioenergy Intertask **Measuring**, Governing and Gaining Support for Sustainable Bioenergy Supply Chains (2016-2018)

### **NREL-CTBE T38/T39 joint activity Part 1**

- To obtain a systematic understanding of the differences between LCA models to
  - Identify major lessons learned for LCA as a policy tool for evaluating the environmental impacts of biofuels
  - Provide guidance to decision makers on opportunities and best practices for LCA use in decision-making
  - Guide researcher, analysts, and decision-makers to more informative and transparent calculations of emissions reductions derived biofuels under policy regimes.

### **IEA Project Context (Task 38):**

**Objective 1. Task 38 Lead Overview of calculation methods and tools to assess the sustainability of various biomass and bioenergy supply chains. Discuss needs, possibilities and limitations of a global, uniform/harmonized framework.** Main focus is GHG and other climate forcers (entire chain) along with other **environmental and social criteria and indicators.**

### Part 2 – environmental and social

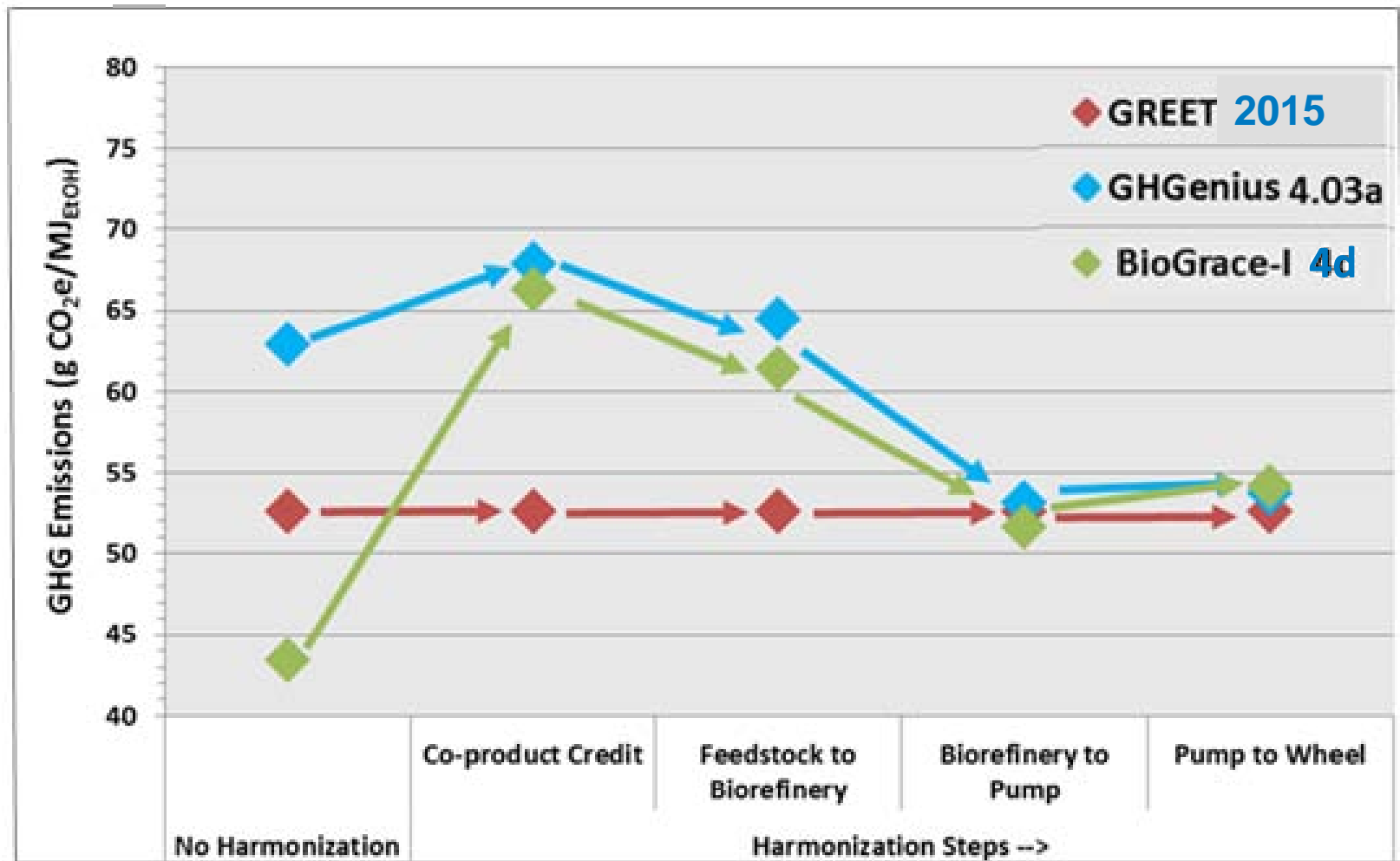
# Harmonized LCA tools from EU and Canada to assumptions as close to and same inputs from US GREET brings results together

Corn ethanol dry milling technology practiced in the United States using natural gas as the major fossil fuel source for process energy

*Technical Accomplishment*

With Ethan Warner and Yimin Zhang, NREL

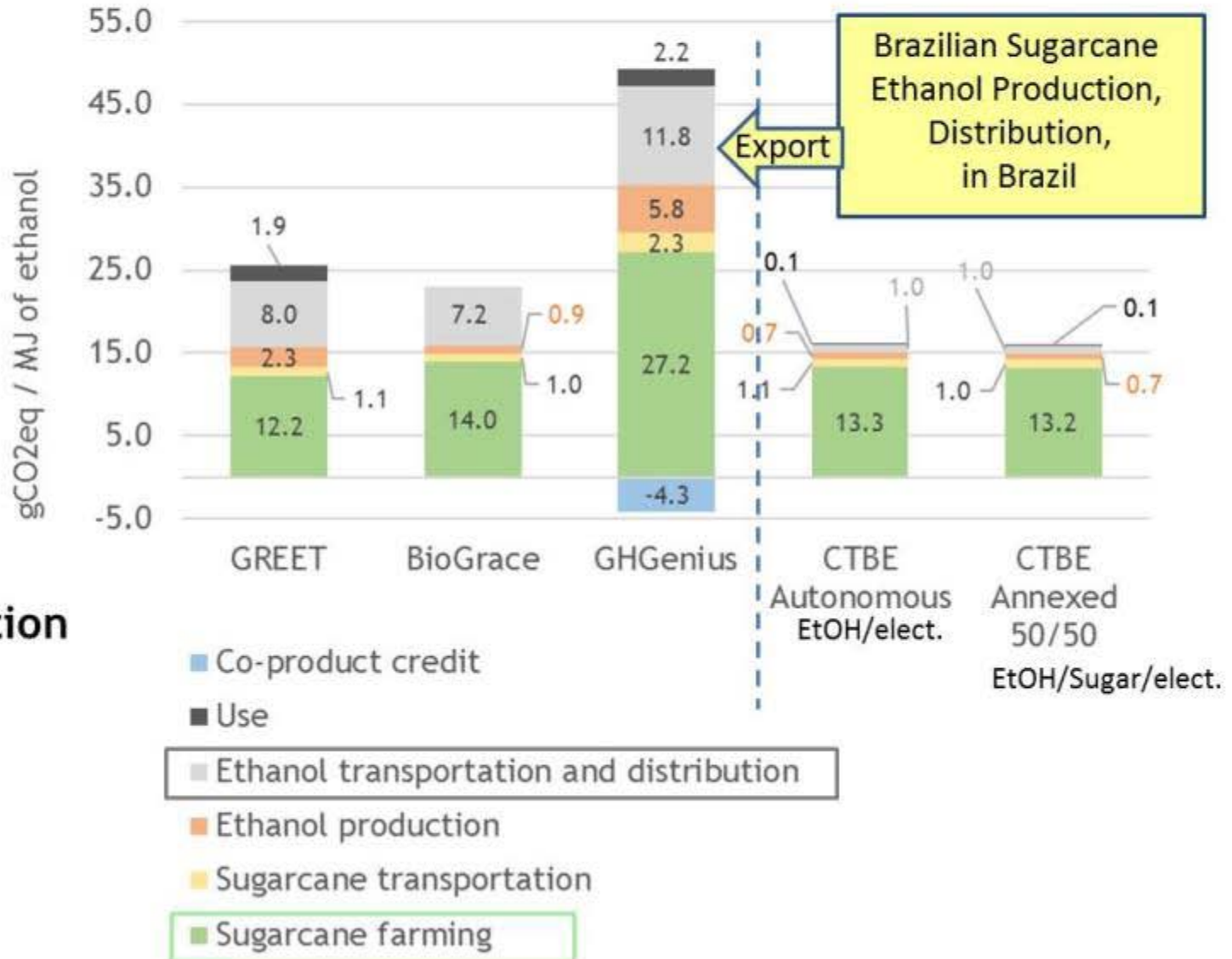
1.2



# Brazilian Partners detail

## across the chain different factors and assumptions

### GHG impacts

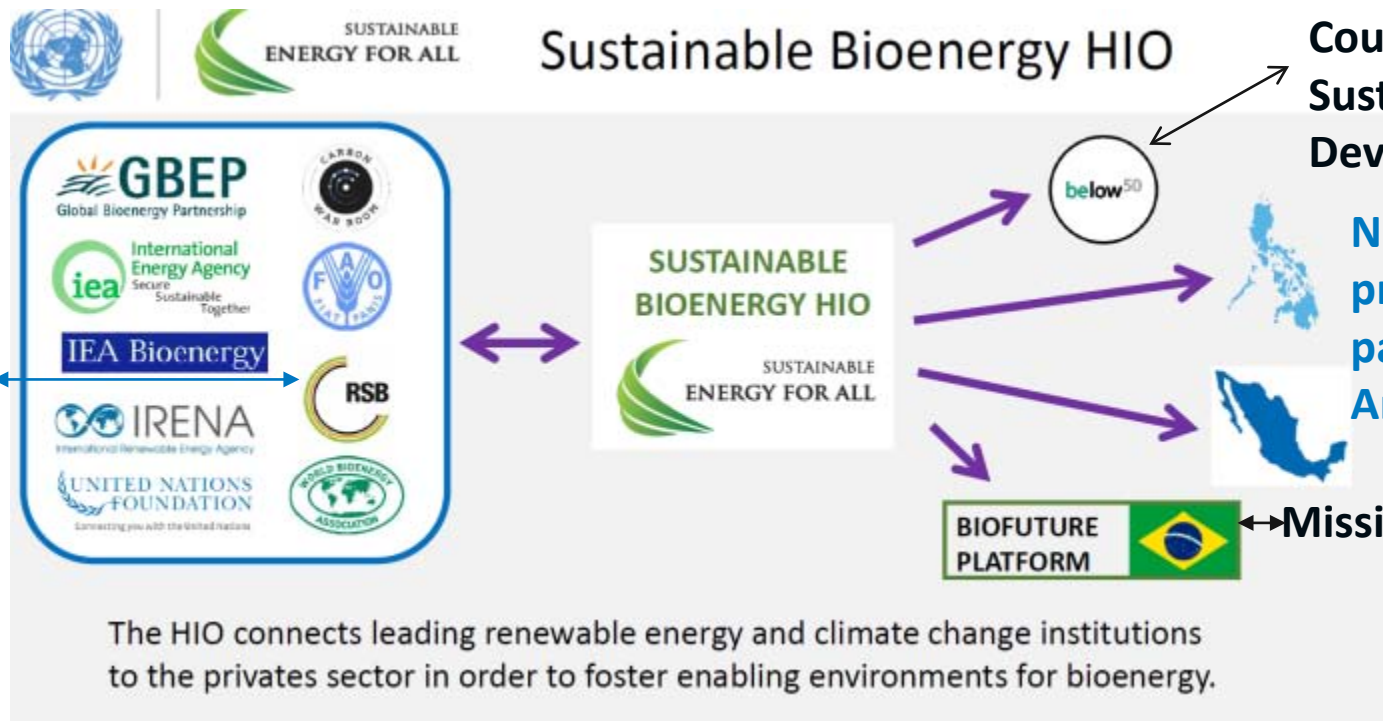


### WTW default allocation

Otavio Cavalett  
 Lucas Pereira  
 Antonio Bonomi

# Cross-Sector Partnerships for Science Based Analysis of Voluntary Sustainability Standards

Technical Approach  
Objectives 1.1 and 1.2



Sustainable Bioenergy High-Impact Opportunity



# Reduce barriers to stimulate the bioeconomy

*Technical Approach*

## Voluntary Sustainability Standards(VSS)

*Objectives 1.1*

### Best in Class Schemes

#### ISEAL full members



- *Certification*, provided by VSS scheme implementation, addresses **reputational and regulatory risk**. Critical to global highly regulated areas, such as aviation.
- U.S. industry-led standard setting process can be perceived as business- and not science-driven products.
- Concerns of Conflict of Interest among organizations developing and implementing standards (certifiers) and auditors.
- European governments-led standards setting processes were harmonized with EU formation; 32% of these new harmonized standards became ISO standards directly.

### Key Activities Followed

- SE4ALL selected the Roundtable on Sustainable Biomaterials (RSB) as their VSS to help guide the partnership toward sustainable products across supply chains. Partners include financing organizations.
- US American National Standards Institute (ANSI)/LEO (Leonardo Academy) 4000 Sustainable Agriculture Standard – approved 2016
- ANSI/ASTM E3066-2016“Practice For Assessing Relative Sustainability Involving Energy or Chemicals from Biomass” (ORNL - ISO)
- Field to Market: Alliance for Sustainable Agriculture (not a VSS) are defining, measuring and advancing the sustainability of major US crop production with farmer members. Works closely with USDA.

# Reduce barriers to stimulate the bioeconomy

Accomplishment: started regionalization of RSB

## North American Forum 10/4/2016: Draft Outcomes under peer review

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Type of document: RSB Guidance  
Status: Draft for stakeholder consultation  
Date of approval:  
Date of publication:  
Version: 1.0

Based on CSBP\*, BETO program participants, USDA directly

**RSB Certification Protocol and Guidance for Harvesting Corn Stover as a Feedstock for Biofuel or Bio-products**

Adapted to the U.S.

RSB reference code: RSB-GUI-01-008-02 (Version 1.0)

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Contact details: RSB - Roundtable on Sustainable Biomaterials  
International Environment House 2  
7 Chemin de Balexert  
CH - 1219 Chatelaine (Geneva)  
Switzerland  
web: <http://www.rsb.org>  
email: [info@rsb.org](mailto:info@rsb.org)

\*CSBP=Council for Sustainable Biomass Production, US VSS, not implemented



*Technical Accomplishment*

Objective 1.1

**Progress report**

**Developing  
United States Compliance Indicators  
for the RSB Principles & Criteria**

Shows examples of links to US generated info on several P&C not generally known in EU countries

Contact details: Roundtable on Sustainable Biomaterials (RSB)  
International Environment House 2  
7 Chemin de Balexert  
CH - 1219 Chatelaine (Geneva)  
Switzerland  
web: <http://www.rsb.org>  
email: [info@rsb.org](mailto:info@rsb.org)

# New science-based evidence routed to integrated assessment model developer and National GHG emissions data providers

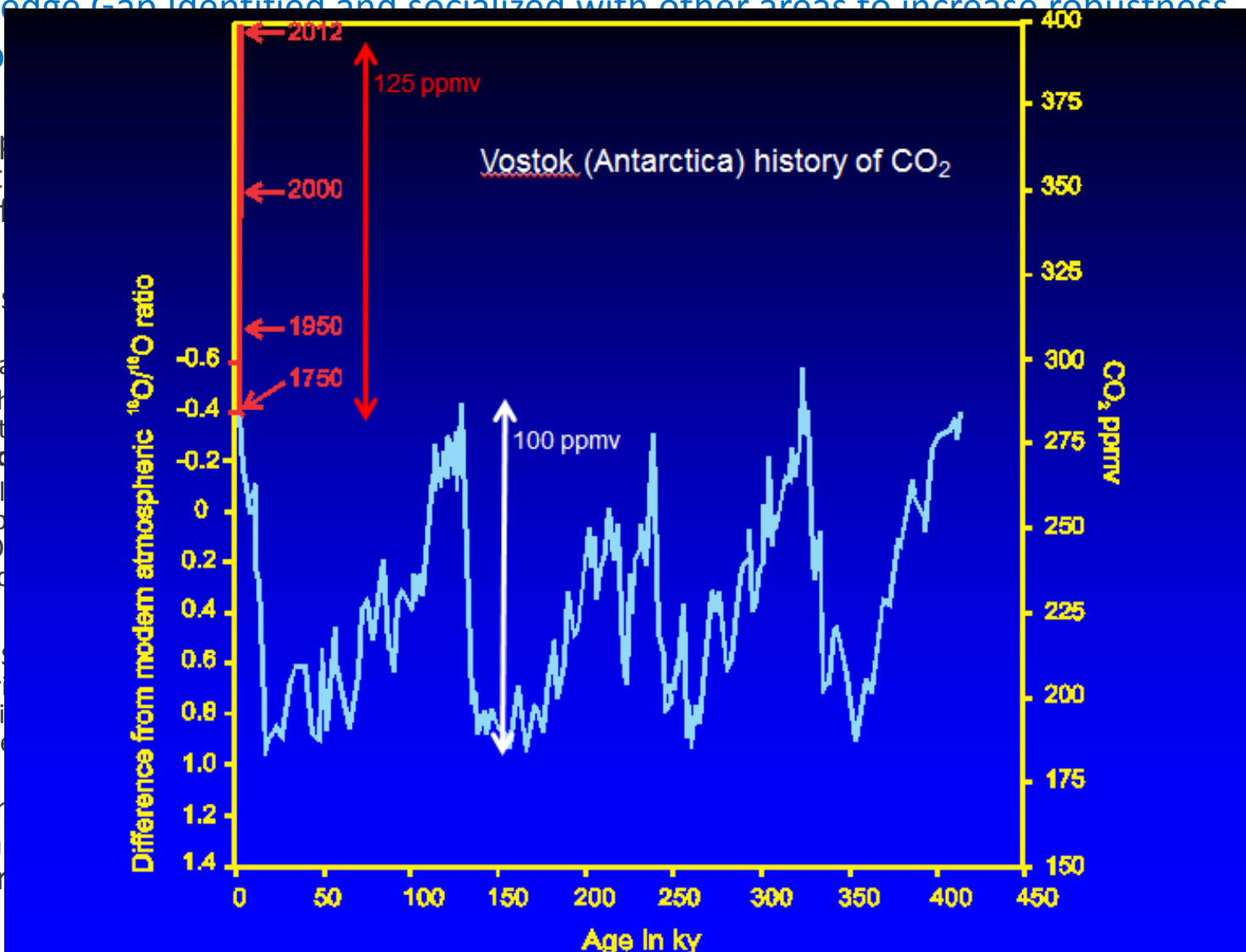
Knowledge Gap Identified and socialized with other areas to increase robustness of info

New paper on sunlight Albedo

1. Discussion Response University of "Finally I have learned a lot accounted I was really great surprise higher CO<sub>2</sub> associated

2. Discussion on capturing combination global level

At the moment and adaptation Shepherd



Simmons, C. T. transient clim

William Hay, Experimenting on a Small Planet, ISBN-13: 978-3642285592



# Bioeconomy and the Sustainable Development Goals



Technical Approach 2.2

Background

Framework Convention on Climate Change

The United Nations System



UNEP United Nations Environment Programme

Specialized Agencies<sup>1,5</sup>  
 FAO Food and Agriculture Organization of the United Nations  
 ICAO International Civil Aviation Organization

UNESCO United Nations Educational, Scientific and Cultural Organization  
 UNIDO United Nations Industrial Development Organization

5<sup>th</sup> Global Environmental Outlook

"Review of Targets for the Sustainable Development Goals – The Science Perspective"

International Social Science Council

International Council for Science (ICSU)



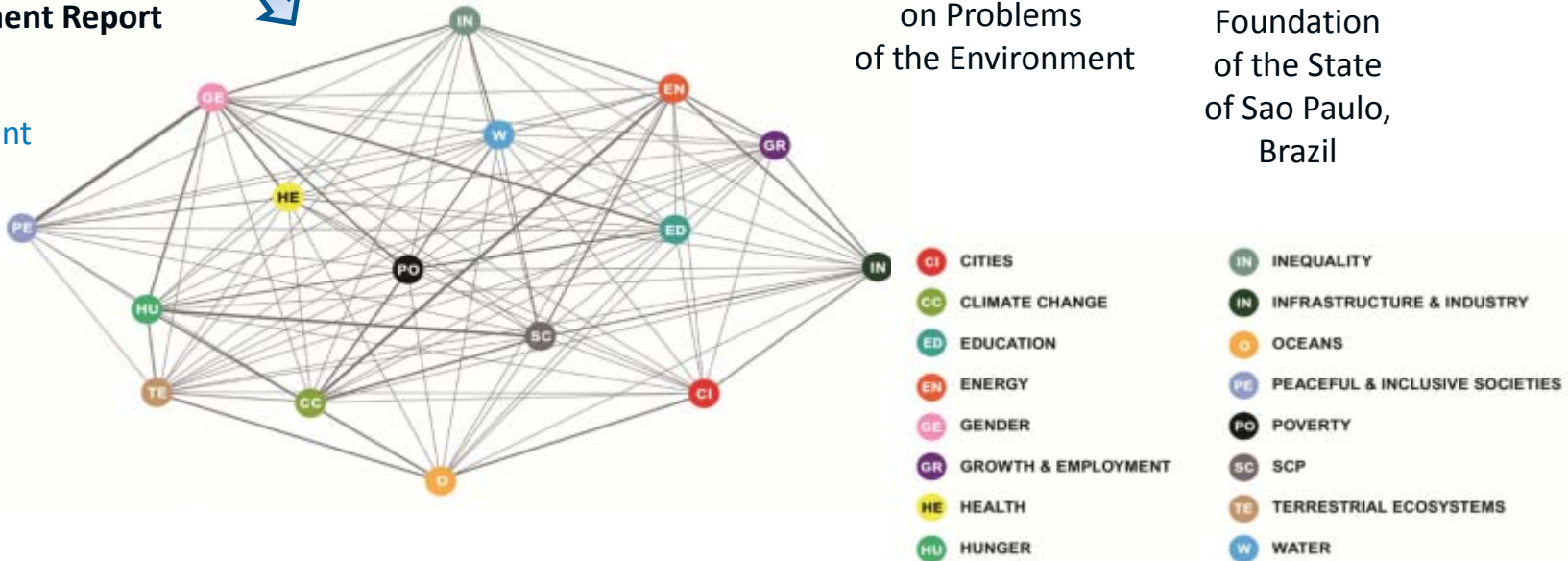
Scientific Committee on Problems of the Environment

Research Foundation of the State of Sao Paulo, Brazil

UN 2015 Global Sustainable Development Report

IPCC 5<sup>th</sup> Assessment Report

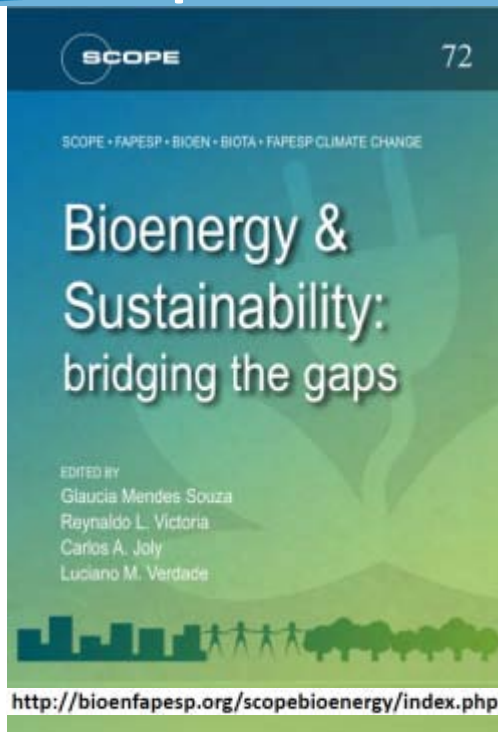
The Paris Agreement



# Expansion of Bioenergy and Sustainability Together

## Impactful multilateral publications

*Technical Accomplishment 2.2*



Policy Brief launched  
EU Sustainable Energy Week  
**June 2015, Brussels, Belgium**



World Bank Bioenergy & Sustainability Symposium discussed scaling up sustainable bioenergy and financing.

**September 2015, Washington DC, USA.**  
Peer reviewed Forum discussion summary in press, **Environmental Management, 2017**

Contributions from 136 experts, 81 institutions from 24 countries. 700-page open e-publication, 2000+ citations.

**Launched April 2015 FAPESP, São Paulo, Brazil**

“This is the ultimate go-to source on bioenergy. It is a comprehensive and inter-disciplinary expert work, extensively reviewed, addressing basically all aspects of sustainability... “ Jesper H. Kløverpris, Sustainability Manager, Novozymes A/S, Denmark (not associated with the effort). <http://www.biofuelsdigest.com/bdigest/2015/04/20/earth-day-3-big-reads-for-a-sustainable-biofuture/>

# Expansion of Bioenergy and Sustainability Together

## Roles of PI, Chum

*Technical Accomplishment  
Objective 2.2*

- SAC= Scientific Advisory Committee

**Update SCOPE #72**

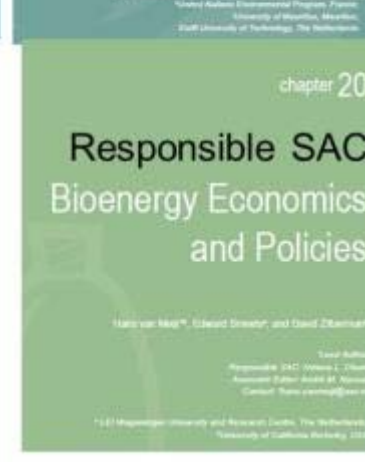
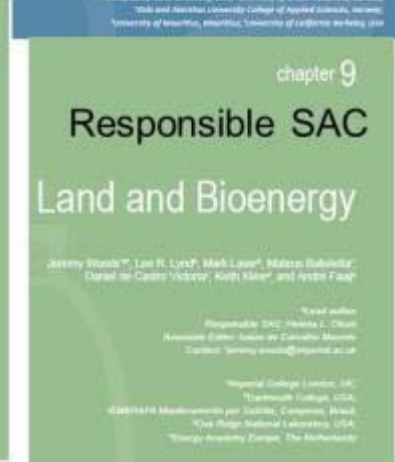
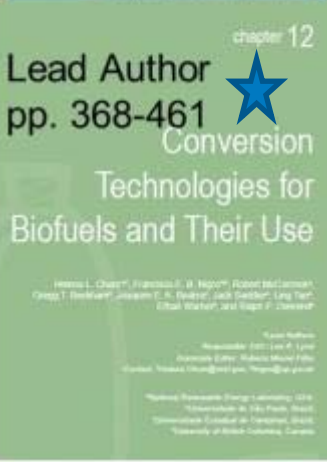
**to address UN SDG Goals and UNFCCC Paris Agreement.**

**Mini Rapid Assessment Process - 11-12 2016  
Focus Latin America and Africa**

**Chum: SAC member  
Discussion Leader:  
Energy Security and Bioenergy.**

**Presentation, discussion  
write up.**

**Updated Policy Brief Outcome**



## 4 – Relevance

- The project supports BETO's Sustainability Program:
  - focus on developing the **resources, technologies, and systems** needed to support a **thriving bioenergy industry** that **protects natural resources and advances environmental, economic, and social benefits**.
- Engage international partners on **improving sustainability models and metrics** and expanding the knowledge base for sustainability analysis which are **critical for the success of an advanced bioenergy industry**.\*
- **Provide strong US participation in the IEA, GBEP, SE4ALL, SCOPE, UNEP, IPCC communities**, and key entities helping finance the expansion of bioenergy and sustainability together,\* in conjunction with improved agriculture and forestry practices.
- **Advance the state of the science and enable** policy-makers to better understand the sustainability implications of increased bioenergy production.\*
- **Decrease barriers to international trade** for U.S. biofuels and bioproducts industry with **increased understanding of U.S. systems of governance and standards practices**
- Compares **tools used for regulatory purposes** to increase the knowledge of policymakers around the world of their **advantages and limitations**. Aim for consensus best practices.

\* Quotes from the AOP Merit Review 2016

# Future Work

VSS = Voluntary Sustainability Standards; IEA = International Energy Agency; EBST = EBST=Expand Bioenergy and Sustainability Together

Milestone	Area/ Status	Quarter /Yr
Voluntary Sustainability Systems – See slide # 15	VSS-1	Q1/2016 ✓
Contribute to ORNL's Q2 milestone: whether the program should invest in a "Sustainability Standards Landing Page" for KDF -- GO/NO GO	VSS-2	Q2/2017
IEA Bioenergy Intertask presentation workshop preliminary results of IEA-2 and Task 38 business meeting, Gothenburg, Sweden (GHG, Energy)	IEA-1	Q2/2017
Harmonized the three regulatory LCA tools for commercial biofuels (US, EU, Canada) – GHG/Energy. Manuscript, summary paper(See slides 10-12; one manuscript complete in revision; one manuscript in final phase)	IEA-2	Q3/2017
Voluntary Sustainability Certification Systems: Deliverable: Lessons learned from VSS1 and related activities.	VSS-3	Q4/2017
SCOPE Bioenergy and Sustainability: Bridging the Gaps Policy Brief	EBST-1	Q1/2018
Commercial biofuels comparison LCIA environmental impact indicators	IEA-3	Q2/2018
VSS assessments contributions to KDF Landing Page pending decision	VSS-4	Q3/2018
Comparing social Lifecycle Assessments (sLCA), hybrid sLCA integrated with economic input-output (E-IO)analysis, JEDI (Jobs and Economic Impact)model	IEA-4	Q4/2018
LCIA assessment of first-of-a-kind advanced ethanol plants in Brazil, United States, and Europe (pending data availability) (others in background)	IEA-6	Q3/2019

# 5-Summary

Category	Project Approach
Overview	The project <b>analyzes and synthesizes</b> key global bioenergy/bioeconomy activities to <b>identify opportunities and address challenges to stimulate</b> the U.S. bioeconomy and improve sustainability. Project activities improve sustainability assessments (environmental, social, economic) of integrated biomass systems.
Approach	Partnering and stakeholder engagement in bioenergy and sustainability assessment is conducted for U.S. government/BETO UN- or IEA-related multilateral initiatives, which are updated periodically. The task: (1) designed a systematic process to evaluate tools to assess the (environmental, economic, social) sustainability of various biomass and bioenergy systems through collaboration with the IEA Bioenergy community; (2) is assessing voluntary sustainability standards (VSS) ; (3) participates in multilateral bioeconomy assessments.
Technical Accomplishments	(1) The RSB (Roundtable Sustainable Biomaterials), a leading VSS, drafted the application of its principles and criteria to the US and provided a draft corn stover removal protocol for the US conditions, using prior work of a US VSS (CSBP) and program information; (2) The PI addressed, e.g., a gap in modeling, and participated in the update of SCOPE leading the area of energy security and bioenergy.
Relevance	The project: (1) engages international partners on improving sustainability models and metrics and expanding the knowledge base for sustainability analysis which is critical for the success of an advanced bioenergy industry; (2) works to decrease barriers to international trade from U.S.
Future Work	(1) continue to assess sustainability evaluation tools in various bioenergy and bioeconomy contexts; (2) continue the assessment of VSS; and (3) continue to partner with ORNL, ANL, and INL on sustainability of integrated systems.

# Thank you – partners in 2016-2017

**a.RSB:** Standards Director , Elena Schmitt; Rolf Hogan, Barbara Bramble (Chair)

**b.IEA Bioenergy Task 38** members, U.S. (Alison Goss Eng and Kristen Johnson), Australia (Annette Cowie, Task Leader and Task Manager Miguel Brandao)

**c.IEA Bioenergy Task 39** US co-Task Leader (Jim McMillan, NREL), Canada co-Task Leader (Jack Saddler Univ British Columbia), Brazil (Antonio Bonomi, Otavio Cavalett, Lucas Pereira, CTBE); \* Model developer consultants: Michael Wang, ANL, US, GREET; Susanne Köppen, IFEU, Germany, BioGrace, previously John Neeft (Netherlands); Don O'Connor, S&T Consultants, Vancouver, Canada, GHGenius.

**d.SCOPE** Bioenergy and Sustainability: up-date, FAPESP, Glaucia de Souza; Energy Security Panel: Rodrigo Ciannella (World Agroforestry Center, Kenya), Jon Samseth (SCOPE, Norway), Rubens Maciel (UNICAMP, Brazil), Antonio Bonomi (CTBE, Brazil), Francisco Nigro (USP, Brazil), Vyacheslav Kafarov (Universidad Industrial de Santander, Colombia), Luis Cortez (UNICAMP, Brazil). Partners of the World Bank meeting summary

**e.Sustainability Lab partners** ORNL (Keith Kline, Maggie Davis, Virginia Dale), ANL (Michael Wang), INL (Patrick Lamers); Virginia Dale and the members of the US Southeast Study tour and co-authors of the joint Opinion paper.

**f.ERG/Franklin Associates**, Troy Hawkins

**g. NREL** team members: Ethan Warner, Yimin Zhang

\* Other collaborators join as the project advances.

## Additional Information

1. To the presentation
2. Peer reviewer's response
3. Publications, presentations, honors, etc.

[www.nrel.gov](http://www.nrel.gov)





# Historical Context of activities leading to this project

## Overall Benefits and Impacts

- Chum Coordinating Lead Author of **Bioenergy Chapter in IPCC Special Report on Renewable Resources and Climate Change. 2009-2012** (publication)
- Chum Lead Author Energy Systems and co-author of Agriculture, Forestry and Other Land Use chapters **IPCC 5<sup>th</sup> Assessment Report , 2012-2014** (publication)

## Bioenergy Systems Climate, Environment & Social Methodologies

- **IEA Bioenergy**: 2010-current Task 38 (Climate Effects – cross cutting task) with specific (non GHG effects) and Intertask activities
  - Monitoring **Sustainability Certification** of Bioenergy (2011-2013) – NREL co-author multiple papers
  - Mobilizing **Sustainable Bioenergy Supply** Chains (2013-2015) – NREL pasture intensification Brazil
  - **Measuring, Governing and Gaining Support** for Sustainable Bioenergy Supply Chains (**2016-2018**)


## Bioenergy Benefits Verification

- **RSB** (Roundtable on Sustainable Biomaterials ) 2017
- **U.S.-Brazil Bilateral Sustainability** activities of the MOU to advance cooperation in biofuels (2009) and continues through the Strategic Energy Dialogue
  - Comparison of U.S. and Brazil benchmarks commercial biofuels LCA

## Expansion of Bioenergy and Sustainability Together

- **SCOPE Bioenergy and Sustainability**: Bridging the Gaps Vol. #72 – 2012-2015; update **2016-2017**

# More Detailed Future Work

Milestone	Area/ Status	Quarter /Yr
<p>Voluntary Sustainability Systems – NREL: RSB Technical Working Group of North America meeting will provide draft regionalized RSB indicators for North America modified based stakeholder input and a draft RSB procedure for corn stover removal protocol with input from U.S. participants. Documents will be peer reviewed</p>	<p><b>VSS-1</b></p> 	<p>Q1/ 2016</p>
<p>Contribute to ORNL's Q2 milestone: "Sustainability Standards Landing Page" - GO/NO GO</p>	<p><b>VSS-2</b></p>	<p>Q2/ 2017</p>
<p>IEA Bioenergy Intertask presentation workshop preliminary results of IEA-2 and Task 38 business meeting, Gothenburg, Sweden</p>	<p><b>IEA 1</b></p>	<p>Q2/ 2017</p>
<p>IEA Bioenergy Task 38 and Intertask Collaborations: A milestone explaining 1) that under harmonized conditions, the net emissions are the same for the commercial biofuels (<math>\pm x\%</math>) for the three regulatory tools used (US, EU, Canada), and 2) why different LCA regulatory models give different net GHG emissions. Three levels of information will be provided: 1) Draft manuscripts; 2) Input for Objective 1 of the Sustainability Project; and 3) Draft KDF fact sheet.</p>	<p><b>IEA-2</b></p> <p>#3 decision VSS-2</p>	<p>Q3/ 2017</p>

**VSS** = Voluntary Sustainability Standards; **IEA** = International Energy Agency

# More Detailed Future Work – Future year milestones are adjusted for relevance and progress

Milestone	Area/ Status	Quarter /Yr
<p>Voluntary Sustainability Certification Systems: Deliverable: Lessons learned from VSS1. Part 2. Parallel advances in the U.S. sustainability efforts related to sustainable agriculture ANSI/LEO-4000 and the multi-stakeholder effort Field to Market, the Alliance for Sustainable Agriculture The analysis includes suggestions for BETO’s continued interactions with these stakeholders including possible follow up activities to foster productive interactions among the groups.</p>	<b>VSS-3</b>	Q4/ 2017
<p>SCOPE Bioenergy and Sustainability: Bridging the Gaps Policy Brief</p>	<b>EBST-1</b>	Q1/2018
<p>A milestone comparing the lifecycle impact assessment results for commercial biofuels in the U.S., Brazil, and EU to improve consistency and reduce uncertainty in evaluating lifecycle impacts. Aspects of comparison include: (1) on benchmarking basis showing the evolution of key impacts over time; (2) comparability of methodologies used and appropriateness of data from most recent literature results; (3) specific impacts well studied across several feedstock production areas (e.g., water/pesticides). Output: (1) Manuscripts for publication in peer-reviewed literature; (2) summary of findings for Objective 1 of the Sustainability Project; (3) Best practices for the KDF sustainability web page.</p>	<b>IEA-3</b>	Q2/2018

**VSS** = Voluntary Sustainability Standards; **EBST**=Expand Bioenergy and Sustainability Together; **IEA** = International Energy Agency

# More Detailed Future Work - Future year milestones are adjusted for relevance and progress

Milestone	Area/ Status	Quarter /Yr
VSS assessments contributions to KDF Landing Page pending go/no go decision	<b>VSS-4</b>	Q3/2018
A milestone report comparing social Lifecycle Assessments (sLCA), hybrid sLCA integrated with economic input-output (E-IO)analysis, the JEDI (Jobs and Economic Impact) model (based on IMPLAN an E-IO modified for developing renewable technologies), and other strategies applied to commercial and advanced biofuels. Output: Analyze the methodologies used, report on results from literature; select case studies to test a preliminary framework for simplified social impact analyses.	<b>IEA-4</b>	Q4/ 2018
VSS assessments contributions to KDF Landing Page pending go/no go decision	<b>VSS-5</b>	Q1/2019
A milestone reporting results from the use of the preliminary framework for simplified social impact analyses developed.	<b>IEA-5</b>	Q2/2019
A milestone report, input to the IEA Bioenergy Intertask Project, based on the LCIA assessment of first-of-a-kind ethanol plants in various countries combining information from Brazil, United States, and other countries that join the effort. The input is based on papers published as a result of the joint activities.	<b>IEA-6</b>	Q3/2019
IEA Biomass Conference (triennium) highlighting the Intertask	<b>IEA-7</b>	Q4/2019

VSS = Voluntary Sustainability Standards; EBST=Expand Bioenergy and Sustainability Together; IEA = International Energy Agency

# Reduce barriers to stimulation of the bioeconomy

## Background on standards

- Certain VSS result from multi-stakeholders consultation with full supply chains of the bioeconomy and use continuous improvement to improve its practices in environmental, social, and economic pillars and reduce costs: characteristic of ISEAL VSS members
- Certain governments, companies, and major product distributors increasingly use sustainability *certification*, provided by Voluntary Sustainability Standards (VSS), to address **reputational and regulatory risk**, reduced by *assurance certification per principles and criteria of the specific VSS scheme (not absolute)*. Key in EU.
- UN Agenda 2030 fosters private and public sector partnerships and innovative investment models. SE4ALL selected the Roundtable on Sustainable Biomaterials (RSB) as their VSS to help guide the partnership toward sustainable products across supply chains. Partners include financing organizations. Critical to **global highly regulated areas** such as aviation, dependent on hydrocarbons.

# Peer Reviewer's Comments

- Dr. Chum's frequent presentations and papers help to frame the bioenergy discussion globally but also serve to highlight the work going on in BETO and facilitate its use by all stakeholders. Her participation on boards and in scientific forums helps to reduce the barrier for U.S. trade and economic participation as well as increases the opportunities for the biofuels industry here in the U.S. Biofuel use here in the U.S. has slowed due to blend wall issues, but biofuels are still seen as a way for many regions of the world to create jobs, improve national security, drive GDP and wealth creation, and improve the standard of living especially among rural populations, while also having a positive impact on the environment. I like the increased focus on system effects and would encourage efforts to move from life-cycle-inventory-only work to looking at the impacts on toxicity, human health, etc. With a project like this, communication is not only critical but essential. Maintaining an ongoing dialog with all stakeholders is important. The goal is not only to influence the world stage but to bring that learning back to BETO.
- There is nothing more I can add to the 2013 Peer Review report and I echo that report's sentiments. The PI has kept up the same pace as the last report. BETO gets a lot from the investment in this project. It would be a huge strategic oversight for BETO to alter or discontinue this international engagement. Often times, DOE is the only U.S. agency present in some of these international discussions. BETO should be highly commended for its strategic leadership in this area.

# Peer Reviewer's Comments

- The international activities included in this project have borne much fruit in the past two years. Major milestones include participation in newly released reports from IPCC (International Panel on Climate Change—under the auspices of the United Nations) and from SCOPE (the Scientific Committee on Problems of the Environment). These reports may pave the way for a much better understanding of the benefits and trade-offs of bioenergy and a much better understanding of how to implement bioenergy sustainably.
- This project provides significant contributions to BETO's portfolio. The goal of collaborating with international stakeholders to promote the sustainable development of bioenergy is of great importance. Building common understandings of sustainability will reduce barriers to trade and foster commerce across sectors, which are crucial goals for future bioenergy expansion. The PI has built critical relationships, disseminated important material to the international community, and is well positioned to advance this work.

## PI Response to Reviewer Comments:

We thank the reviewers for very insightful comments and suggestions, and recognition of the leadership of BETO in these activities. This active engagement enables NREL, ORNL, and other program participants to be active in the exchange of information and insights, essential for the global bioeconomy development. We will work on strengthening communications of these activities.

# Publications

- Glaucia Mendes Souza, Maria Victoria R. Ballester, Carlos Henrique de Brito Cruz, **Helena Chum**, Bruce Dale, **Virginia Dale**, Erick C. F. Fernandes, Tom Foust, Angela Karp, Lee Lynd, Rubens Maciel, Artur Milanez, Francisco Nigro, Patricia Osseweijer, Luciano Verdade, Reynaldo L. Victoria, Luuk Van der Wielen. “The role of bioenergy in a climate-changing world,” In Press ENVDEV\_2016\_180
- Strapasson, A., Woods, J., **Chum, H.**, Kalas, N., Shah, N. and Rosillo-Calle, F. "On the Limits of Bioenergy and Land Use for Climate Change Mitigation" Submitted to Global Change Biology- Bioenergy, comments from reviewers in phase of incorporation.
- Berndes, G., **Chum, H.**, Leal, M.R.L.V., Sparovek, G., Walter, A. “Bioenergy Feedstock Production on Grasslands and Pastures: Brazilian Experiences and Global Outlook.” IEA Bioenergy: Task 43: 2016:06, published in 2016, 38 pages. <http://www.ieabioenergytask43.org/wp-content/uploads/2017/01/IEA-Bioenergy-Task-43-TR2016-06.pdf>
- Co-author of Chapter 6 of the IEA Bioenergy ExCo Report: <http://www.ieabioenergy.com/wp-content/uploads/2015/11/IEA-Bioenergy-inter-task-project-synthesis-report-mobilizing-sustainable-bioenergy-supply-chains-28ot2015.pdf> (pp. 137-160)
- “Status and prospects for renewable energy using wood pellets from the southeastern United States” Berndes, Bernier, Bentsen, Brandao, Brown, Chescheir, **Chum**, Cowie, Dale, Diaz-Chavez, Dimitriou, Donnison, Egnell, Emory, Goss Eng, Gustavsson, Hansen, Hoyt, James, Jenkins , Johnson, Kline, Koponen, Levesque, Lockhart, Malmsheimer, Nair, Negri, Nettles, Parish, Schweinle, Slade, Smith, Stupak, Trianosky, Walter, Wear, Wellisch, Whittaker, Wigley. Opinion paper accepted for publication in the Global Biology Change-Bioenergy, led by Virginia Dale,
- Pelkmans, L., L. Goovaerts, C. Goh, M. Junginger, J. van Dam, I. Stupak, C. T. Smith, **H. Chum**, O. Englund, G. Berndes, A. Cowie, E. Thiffault, U. Fritsche and D. Thrän (2014). The Role of Sustainability Requirements in International Bioenergy Markets. In International Bioenergy Trade: History status & outlook on securing sustainable bioenergy supply demand and markets. Series: Lecture Notes in Energy Vol. 17, Junginger M., Goh C. S., Faaij A. (Eds.) pp. 125-149, ISBN: 978-94-007-6981-6
- See also page 19 for SCOPE Bioenergy and Sustainability: Bridging the Gaps publications.



# Presentations

- At the Southeast Tour led by BETO/CBES/ORNL tour, sponsored by the Technology to Market BETO program, Chum was tasked to explain the role of innovation in bioenergy in March 2016. The specific example of the global RD&D efforts on biomass pyrolysis, greatly advanced by the IEA Bioenergy Pyrolysis task, which over the past 25 years contributed to four leading commercial developers in several countries reaching 250 metric tonnes/day and several 400 MT/day in development. Significant progress in standards for biomass pyrolysis oils were made. Then Chum linked them with the innovation in multiple countries that the CRADA Petrobras/NREL was able to bring together to advance the commercialization of the direct pyrolysis coupling to petroleum refineries' FCC units for testing at a very significant scale yielding data for the NREL technical and economic assessment of the technology in collaboration with Ensyn Corp. The coprocessed fuels received EPA approval to be a commercial product sold in the U.S. and the route has been approved by US EPA and CARB.  
<http://web.ornl.gov/sci/ees/cbes/studytour2016/pdfPresentations/PetrobrasNRELCRADAAikenSC.pdf>
- 14th International Symposium on Bioplastics, Biocomposites (Guelph, Ontario), plenary session on Climate Change, Bioeconomy and Sustainability. Chum's talk was on "The Bioeconomy, Climate Change, and Sustainable Development"
- IRENA and the National Institute of Energy Efficiency and Renewable Energy (INER) of Ecuador workshop, Cooperative Research and Innovation Liquid Biofuels for the transport sector, November 25, 2016, Chum was the plenary speaker on Research and Development Initiatives on Biofuels for Transport. Objective discuss ongoing collaborations across countries.
- Warner, E, Chum, H. "Tools for greenhouse gas (GHG) assessment for biofuels: a comparison" at the 2015 IEA Bioenergy Conference." Chum presented initial results of the harmonization methodology  
[http://ieabioenergy2015.org/fileadmin/veranstaltungen/2015/IEA\\_Bioenergy\\_Conference/S08-4\\_Chum.pdf](http://ieabioenergy2015.org/fileadmin/veranstaltungen/2015/IEA_Bioenergy_Conference/S08-4_Chum.pdf)
- Presentations and reports prepared at for the twice a year meetings of the IEA Bioenergy Task 38 and for the joint task 38/39 on harmonization.

# Helena Chum Honors

Awarded by the Biofuels Digest, a 3000 bioeconomy circulation magazine:

- “Top 100 People in the Advanced Bioeconomy” for 2017, #59, with Philip Pienkos, PhD, Tom Foust
- “Top 100 People in the Advanced Bioeconomy” for 2016, #61, with Philip Pienkos, PhD, Tom Foust
- “Top 125 People in the Advanced Bioeconomy” for 2015, January 2015. At number 74, the NREL contributors: Philip Pienkos, PhD, Tom Foust, Mary Bidy, Helena Chum for NREL. Chum honored at the 2015 Annual Bioeconomy Leadership Conference for the assessments linking stage of development of technologies

Expertise sought in sustainability and biomass and bioenergy systems

- Chum and Talmadge invited to be members of the CARB Coprocessing Technical Working Group in December, 2016
- Chum responded to the Expert Survey on Problems and Response Options of Climate Change Mitigation from the Mercator Research Institute on Global Commons and Climate Change.
- Provide input to the TRL (Technology Readiness Levels) Survey of the EUROPEAN COMMISSION \_ TRL Project: invitation to eSurvey
- Chum External Reviewer of the study Sustainability issues associated with liquid biofuels, project of the Royal Academy of Engineering of the UK. Review March 2017.
- International Advisory Committee of the Brazilian BioEnergy Science and Technology Conference (BBEST 2017) will be held from 17 to 19 October 2017. The theme of the 2017 meeting is "Designing a Sustainable Bioeconomy". (<http://bbest.org.br/>).
- Advisory Board Member of the new Elsevier publication Renewable Energy Focus (<http://www.journals.elsevier.com/renewable-energy-focus/editorial-board>).
- 2016- Delegate of the Government Chamber of the Roundtable on Sustainable Biomaterials (RSB)
- 2013-2015 Served as member of the Board of Directors of the RSB
- 2009-2011 Served as member and chair of the Government Chamber of the Roundtable on Sustainable Biofuels